

who are physically sound and hardy ; but it is a great strain upon nerves already wearied with protracted work, to go through the sleeplessness, the dust, the heat, the worry, and the anxiety of rapid and long journeying, while leisurely travel is exceedingly expensive. Of course if you have but a week or two of time at command, and you wish to see a great deal in a superficial way, a swift, flying excursion by rail and boat may be just the thing for you to choose. One must have a fair share of self-knowledge to make a wise choice; for, after all, enjoyment is very much a matter of temperament and health.

The person who has a special study, like botany, ornithology, geology, or some particular phase of nature is more certain than others of finding, in almost any unworked region or nook, fresh materials for enjoyable investigation. In fact to such an one the woods, fields, roadsides and stream-banks round about home are never exhausted. Every walk, every drive, every run awheel discloses new subjects for the note-book, and there is no end to the mild excitement of discovery and collection.

Speaking in a general way, next after finding a pleasant and profitable vacation at home, the cheapest and best outing will be that which involves the least public travel. One should first determine what is to be done for pastime. Is it boating? is it summer study? is it sight-seeing? is it health-seeking?—what is it? Settle this finally before thinking of where you are to go. The next consideration is how to gain

one's object in the cheapest and best way.

If your object is to forget study and so rest the mind, look around for the nearest place where congenial company and light amusements may be had without any of the social exactions which break in upon personal freedom. If you wish to continue study under circumstances favorable to outdoor exercise and healthful habits, go to a summer assembly or school where you can largely control everything connected with your work and your play. The main thing is to be satisfied with what you choose, for contentment is the foundation of every healthful pleasure.

As to expense, what is economy for one person is ruinous extravagance for another. In choosing your method of enjoying your outing bear in mind that an ambition beyond the limit of your pocket-book is but a bid for difficulty and disappointment. Make up your mind at the outset to be happy with what is easily within your reach; for no amount of longing can possibly add a dollar to the sum at your command. And as for dress, make the simplest outfit serve your turn. It is a matter of common observation that those who are least able to afford it dress the most expensively when out for a summer vacation. You may rest assured that nobody is going to notice your clothes. Most people are too busy thinking of themselves to make any note of what you are doing or wearing; moreover an outing is not just the opportunity for personal show. To be inexpensive an outing must be simple, and let simplicity begin with the wardrobe.

THE VENOM OF SNAKES.

BY ROBERT VON LENDENFELD.

TRANSLATED FOR "THE CHAUTAUQUAN" FROM THE GERMAN "UEBER LAND UND MEER."

THERE are only a few mortals who regard snakes with any other feeling than that of purest aversion. This feeling is fully justified, for, although many snakes are not venomous, many more are harmless, and, at least in our temperate climate, all are useful as mouse-exterminators,

yet a considerable number of them wage a ceaseless war against the life of us mortals. Who does not know of the dangerous venomous serpents of the tropics? Who is not aware that in India an average of twenty thousand persons yearly die from the bite of the hooded serpent?

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Of course from very early times medicinal science has been searched for a means to counteract the fearful results of this venomous snake's bite. Yet every such effort was in vain until last year, when Calmette at the Pasteur Institution in Paris and then Fraser in Edinburgh succeeded in finding a remedy for snake poison. This antidote is obtained on the same plan as those substances with which Pasteur, Roux, and Behring have battled with dog bites and diphtheria: it is a counteracting serum.

It is very noteworthy that many nations, races, and castes lowest in civilization have for a long time protected themselves against poisoning from snake bites by a method which never until the present time, the twentieth century, has been discovered by European scientists. The races of Psyller in Africa, Morser in Italy, and Guner in India, ages ago possessed a means to insure themselves against poisoning from snake bites, and to-day there are people who are not harmed by snake poison, if we may believe the descriptions of travelers. Such are the negroes on the Guinea coasts, the race of Eisower in Barbary, some fakirs and snake-charmers in India, the inhabitants of Mozambique, and some Kafirs in South Africa. The means used by all these peoples to secure immunity from snake venom consists in taking as medicine the venom, either fresh or dried, from the venom glands of snakes. The majority eat the venom, but in Mozambique the same result is gained by inoculating with it. That these peoples really do make themselves proof against snake bites in this way seems to be sure beyond a doubt.

Although this method was made known long ago in Europe by travelers, nobody seemed to take any notice of it until the experiments of Pasteur and his school had demonstrated the possibility of utilizing it. Then scholars began to study the effects on animals of feeding snake venom and of inoculating with it, and to convert into scientific capital the avowals of these fakirs, Kafirs, etc.

Different animals are affected in different degrees by snake venom, and the venom of

different snakes varies in strength. But for animals of the same kind, and for one and the same kind of snake venom, it is stated that the amount of venom that is sufficient to kill an animal, that is the minimum fatal dose, is exactly in proportion to the bodily weight of the animal.

After the minimum dose of snake poison for guinea pigs, frogs, rabbits, white rats, and cats had been ascertained by a number of experiments an attempt was made to secure for these animals immunity against poison. In the first place a dose of venom considerably less than the minimum fatal dose was injected into each one, and at intervals of from eight to fourteen days increasingly larger amounts were injected, until finally the doses exceeded the original fatal dose. At first the increase in the venom doses must be very gradual, but later considerably more is added each time.

By means of this method Calmette succeeded in making animals proof against sixty times their minimum fatal dose, while Fraser by the same method made a rabbit able to withstand fifty times its fatal dose. The remarkable thing about the latter's experiment was that the test animal remained entirely healthy and strong and gained considerably in weight during the time it was taking the poison.

These experiments show that the organism can become accustomed to poison, and that very quickly and in very large quantities. It is not easy to demonstrate through what process this takes place. The most likely explanation seems to be that in consequence of the irritation caused by the constantly increasing doses of poison introduced into the test animal there is formed in its blood an antidote that chemically changes the snake venom and so makes it harmless, or at least counteracts the natural evil consequences of its effect on the organism. At any rate it had to be acknowledged that the blood of an animal that had been made snake proof had certain characteristics lacking in ordinary blood. This was proved without difficulty by a number of experiments such as the following:

The experimenter took some blood of a

poison-proof animal, extracted from it the liquid part (the serum), dried it under an air-pump, and finally injected solutions of the blood serum thus prepared into animals which had not been made poison proof. The same experiment was repeated many times. Next a certain amount of the inoculating serum was mixed with an amount of poison exceeding the minimum fatal dose, and both together were injected into an animal. Then the venom and the serum were simultaneously injected, but in different parts of the body; then first the inoculating serum and later the poison, and finally the venom was injected a half-hour before the serum.

These experiments, tried in great numbers and with the most varied quantities of venom and serum, show that the effect of the venom really is lessened by the serum, is entirely prevented by it in proper proportions, and therefore that the serum really is an effective safeguard against snake bites. Furthermore, they show that the amount of serum necessary to counteract the effect of venom is in direct proportion to the amount of venom injected, and therefore that only the quantity of venom exceeding the minimum fatal dose comes into consideration. If the amount of venom injected amounts to but little more than the minimum fatal dose, then a minimum amount of serum is sufficient to preserve life; but this amount neutralizes only the excessive amount of poison.

It remains to say that animals who have been made proof against one kind of snake have the advantage of being proof against other kinds of snakes, and their serum—so our experiments at present indicate—is a preventive against every kind of snake venom.

Direct experiments to show the extent of man's susceptibility to snake venom have not yet been made. His omnivorous character would place his susceptibility to hooded-snake venom between that of the cat and that of the rabbit. Hence, to kill a man weighing 143.299 pounds avoirdupois from 2.16 to 2.31 grains of the venom would be required. This is the minimum fatal dose.

Cunningham has ascertained that a healthy, full-grown, unaroused snake in biting gives out from its poison glands between 1.78 and 11.2 grains of poison; but from the nine cases observed only one, which apparently was a very exceptional case, gave out the highest amount, 11.2 grains. All the other cases were below 6.17 grains, their average being 3.009 grains.

If our premises are correct, it follows that in most instances the amount of venom given out by the hooded snake exceeds man's minimum fatal dose, and therefore in most instances the bite of this snake proves fatal. Yet very often a part of the venom injected by a snake's bite bleeds out or is sucked out. Of course the wound must be sucked out immediately, and if possible this should be done by the one bitten. When these precautions are taken, frequently the amount of venom that passes into the organism is less than the minimum fatal dose, and the wounded one may escape with his life, after a more or less severe sickness.

Even in fatal cases sixty-four per cent do not die immediately, but live a day after they are bitten. From this fact it is concluded that in sixty-four per cent of the cases the amount of venom that passes into the organism is only a little in excess of the minimum fatal dose. Thus the victims of a snake bite who are not too strongly poisoned may be saved from death by the injection of a little of the counteracting serum, and by using a larger quantity of the serum many may be rescued who otherwise would die very soon.

We already have referred to the fact that a number of wild peoples, the Eisower and Kafir tribes, make themselves proof against snake bites by eating snake venom, and that many experiments have been made in this direction. The inference is that snake poison when taken into the stomach of a man or a test animal has little or no poisoning power. Fraser has fed white rats a thousand times their minimum dose without producing any noticeable effect upon them. A Kafir shepherd declared that eating snake poison always had an intoxicating effect on him. Authentic information on

this point is lacking, and it is scarcely expected of European travelers in the tropics that they will indulge in anything so dangerous as snake poison just to prove the assertion of the shepherd. However, experiments of feeding venom to white rats have given the sure, positive result that eating venom on several days, until the doses have been increased to not more than fifty per cent above the minimum fatal dose, will make white rats entirely proof against snake poison.

Thus we see that not only the injection of the inoculating serum but also eating snake poison secures immunity from the evil effects of snake bites.

While one can easily recognize the effect of injecting the serum as being that of a chemical acting directly on the venom, it is not easy to get an idea of the protecting power of venom swallowed. At any rate it

can not be absorbed into the walls of the intestines and passed into the organism unchanged, because then its effect would be as deadly as if it had been introduced into the body directly through a bite. It seems more likely that the action of the juices of the stomach and intestines changes it into some venom-proof product, which then is absorbed by the walls of the intestines and carried into the blood.

One theory is that this product is identical with every product which exists in the blood through the repeated injection of poison, and which gives the serum its poison-proof quality; and this product apparently is the result of the chemical decomposition of the poison, which has a fermenting, enzymotic, destroying effect on the poison, just as the poison has on the living albumen of the human organism.